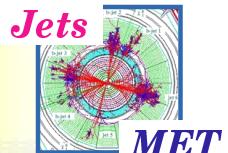




INCLUSIVE SUSY TRIGGER @ $2 * 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$



Salavat Abdullin, UMD

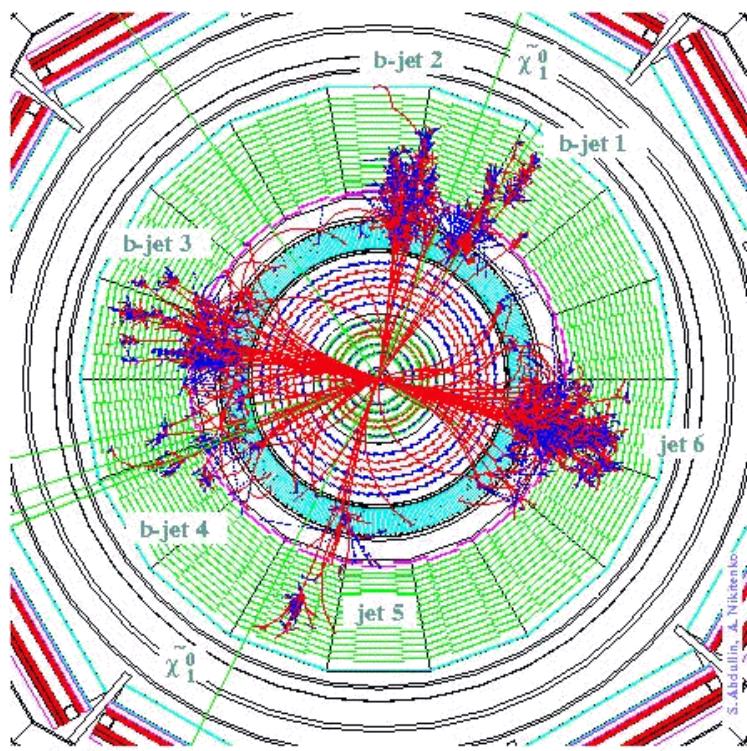
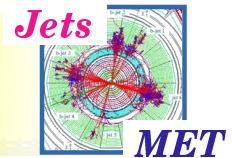


- What's the SUSY from Jets/MET point of view
- Probing points
- L1 signal selection *
- L2 signal efficiency vs QCD rate*
- Last remarks and plans

* Andrei Kirokov's jet corrections for low luminosity are applied
[http://home.fnal.gov/~sceno/jpg/fall20012e33/...](http://home.fnal.gov/~sceno/jpg/fall20012e33/)



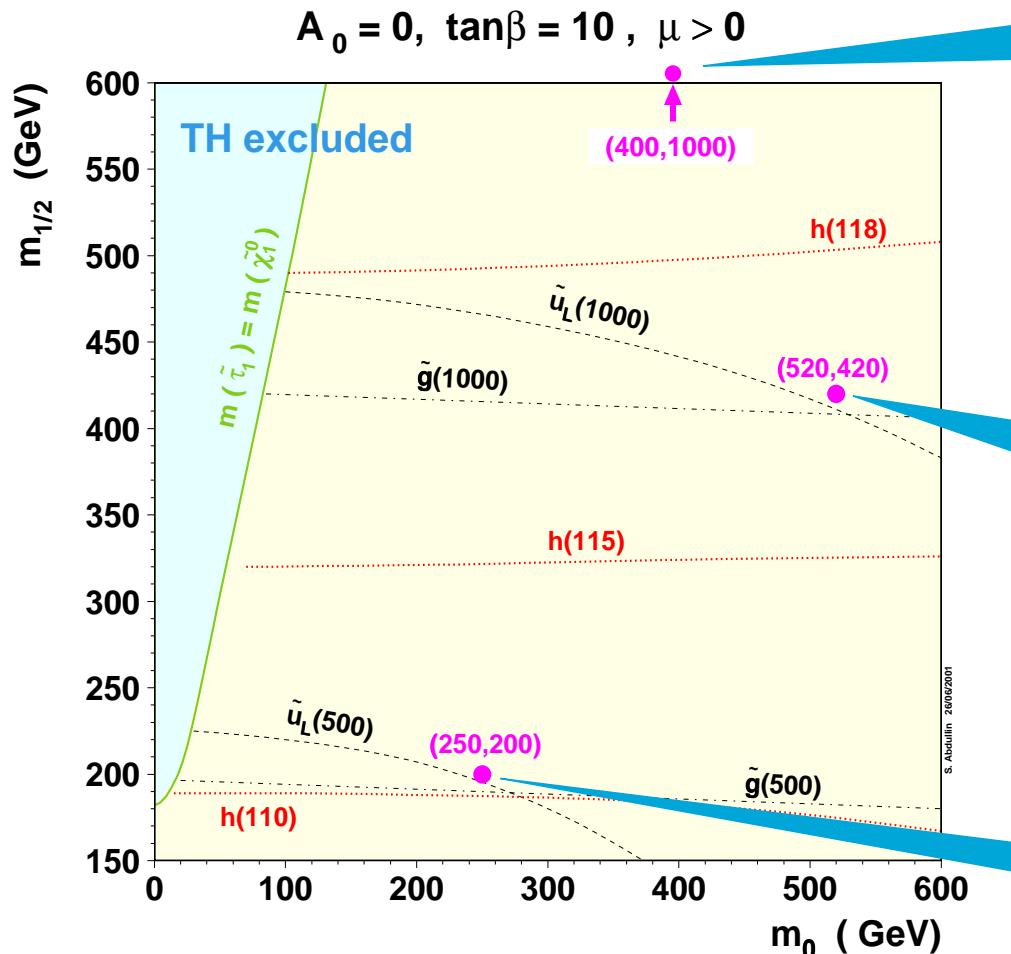
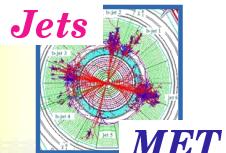
GENERIC SUSY



- Multijet + (leptons) + E_T^{miss} events
- Six mSUGRA points
are available for low-lumi study
 - M_{SUSY} from 0.5 TeV (beyond Tevatron II reach)
to ~ 2 TeV
 - $m(\tilde{g}) \approx m(\tilde{q})$
 - $\tan \beta = 10$ ("preferred")
 - $\mu > 0$ - the sign doesn't play a big role,
though positive one is favoured by g-2
"indirect" constraint - anomalous
magnetic momentum of muon



PROBING POINTS



$m(\tilde{\chi}_1^0) = 423$ GeV $m(h) = 121.9$ GeV
 $m(\tilde{g}) = 2154$ GeV $m(\tilde{u}_L) = 1993$ GeV
 $\sigma \sim 18$ fb, requires $\int Ldt \sim 20-25$ fb $^{-1}$
typical cuts: $E_T' > 800$ GeV, $N_j \geq 2$
3 $E_T^j > 300, 150$ GeV

$m(\tilde{\chi}_1^0) = 177.5$ GeV $m(h) = 116.8$ GeV
 $m(\tilde{t}_1) = 726$ GeV
 $\sigma = 2.24$ pb, requires $\int Ldt < 100$ pb $^{-1}$
typical cuts: $E_T' > 300$ GeV, $N_j \geq 3$
2 $E_T^j > 200, 100, 50$ GeV

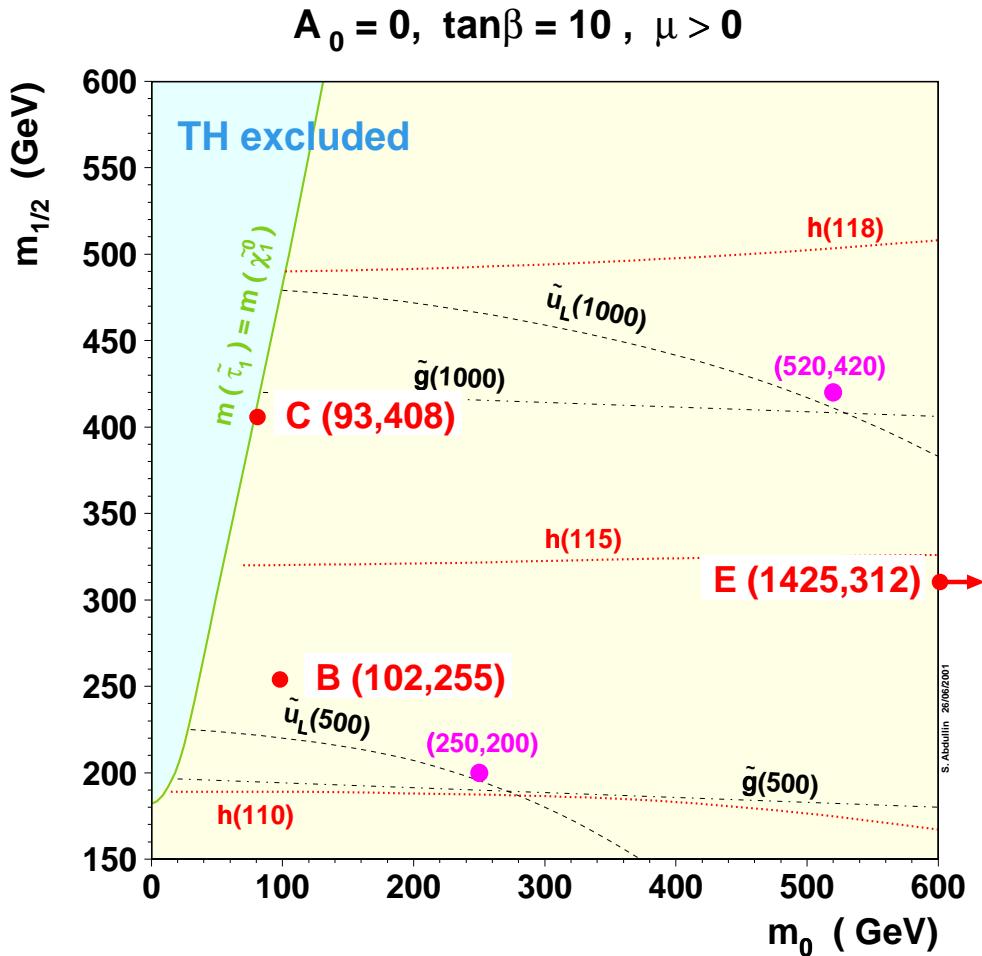
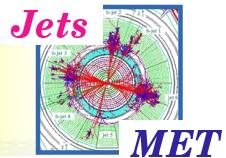
$m(\tilde{\chi}_1^0) = 79.0$ GeV $m(h) = 110.7$ GeV
 $m(\tilde{t}_1) = 352$ GeV
 $\sigma = 115$ pb, requires $\int Ldt < 10$ pb $^{-1}$
typical cuts: $E_T' > 200$ GeV, $N_j \geq 2$
1 $E_T^j > 100, 50, 50$ GeV

- Typical off-line signal efficiency :
20 - 70 % (@ 0.5 - 2 TeV)



MORE PROBING POINTS ...

● taken from paper hep-ph/0106204 by J.Ellis et al.



☞ All 3 points are within cosmologically interesting region ...

☞ Point B :

$$m_h = 113 \text{ GeV}$$

$$m_{\tilde{g}} = 606 \text{ GeV}$$

$$m_{\tilde{q}} = 500-550 \text{ GeV (400 for } \tilde{t}_1)$$

close to $g_\mu - 2$ limit

tau-enriched, quite enough sleptons

☞ Point C :

$$m_h = 117 \text{ GeV}$$

$$m_{\tilde{g}} = 932 \text{ GeV}$$

$$m_{\tilde{q}} = 800-830 \text{ GeV (635 for } \tilde{t}_1)$$

in the coannihilation "tail"

lower jet multiplicity, higher MET

☞ Point E (big $\tilde{\chi}\tilde{\chi}$ fraction ~ 40 %) :

$$m_h = 116 \text{ GeV}$$

$$m_{\tilde{g}} = 804 \text{ GeV, 3-body decays (softer)}$$

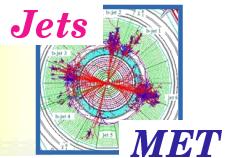
$$m_{\tilde{q}} = \sim 1500 \text{ GeV (987 for } \tilde{t}_1) \rightarrow \text{gluino}$$

"focused point"

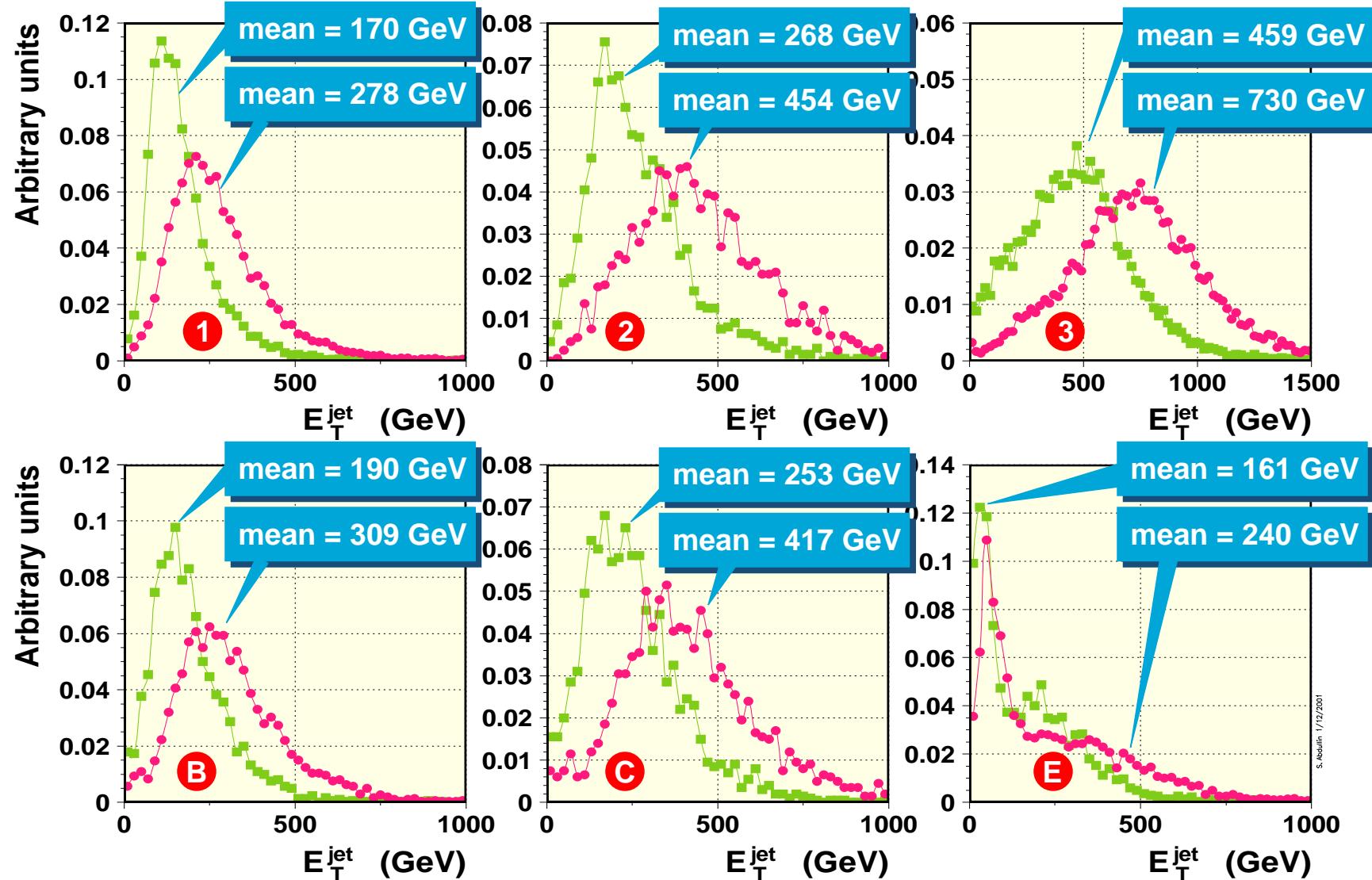
high jet multiplicity (incl. b's), lower MET



PROBING POINTS DISTRIBUTIONS : L2 JETS

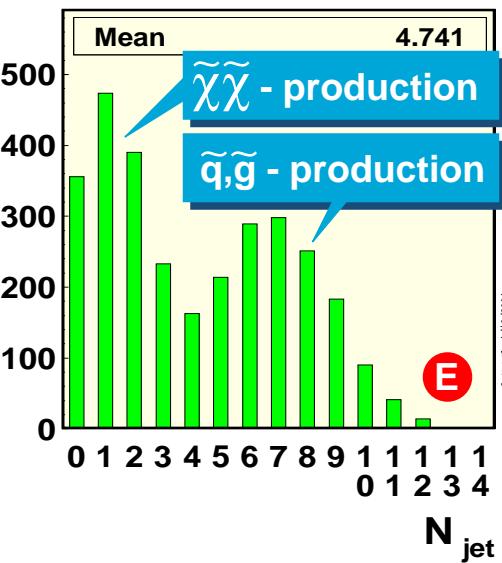
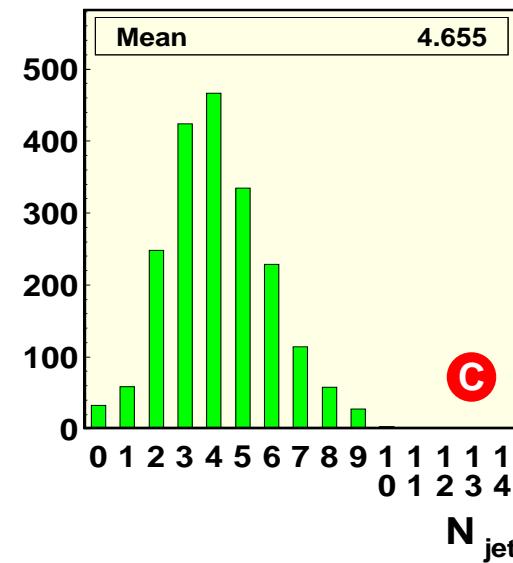
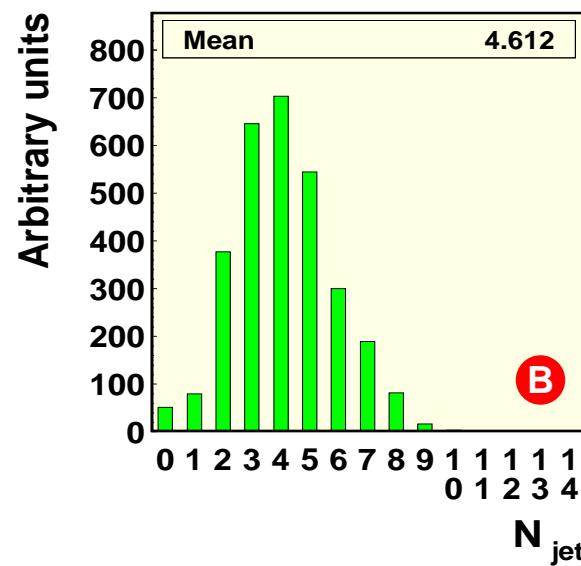
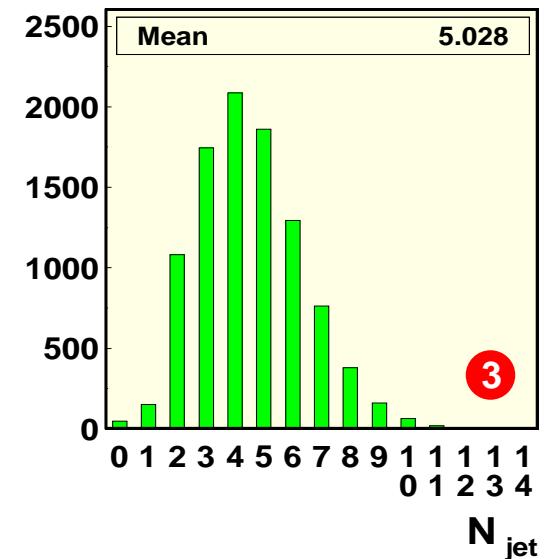
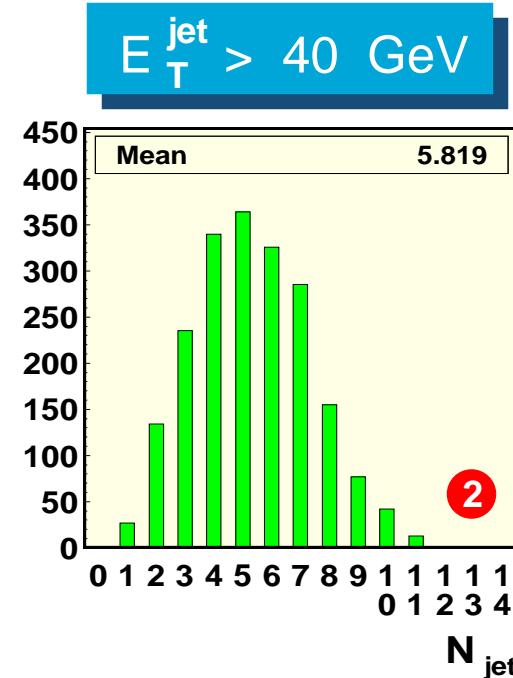
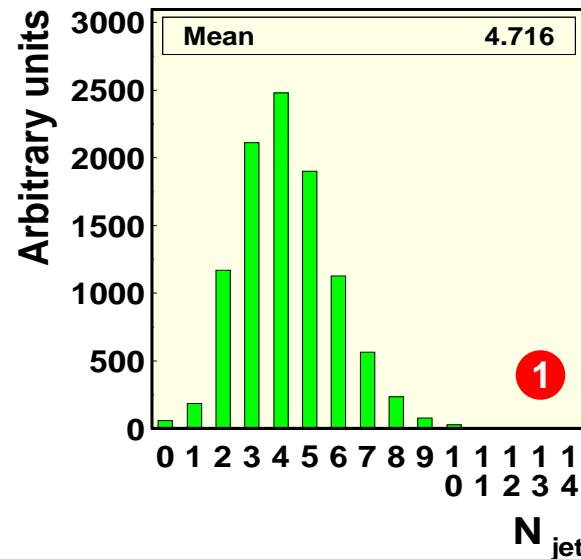
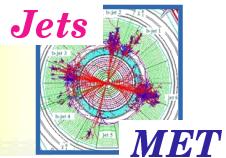


Hardest and next-to-hardest jet



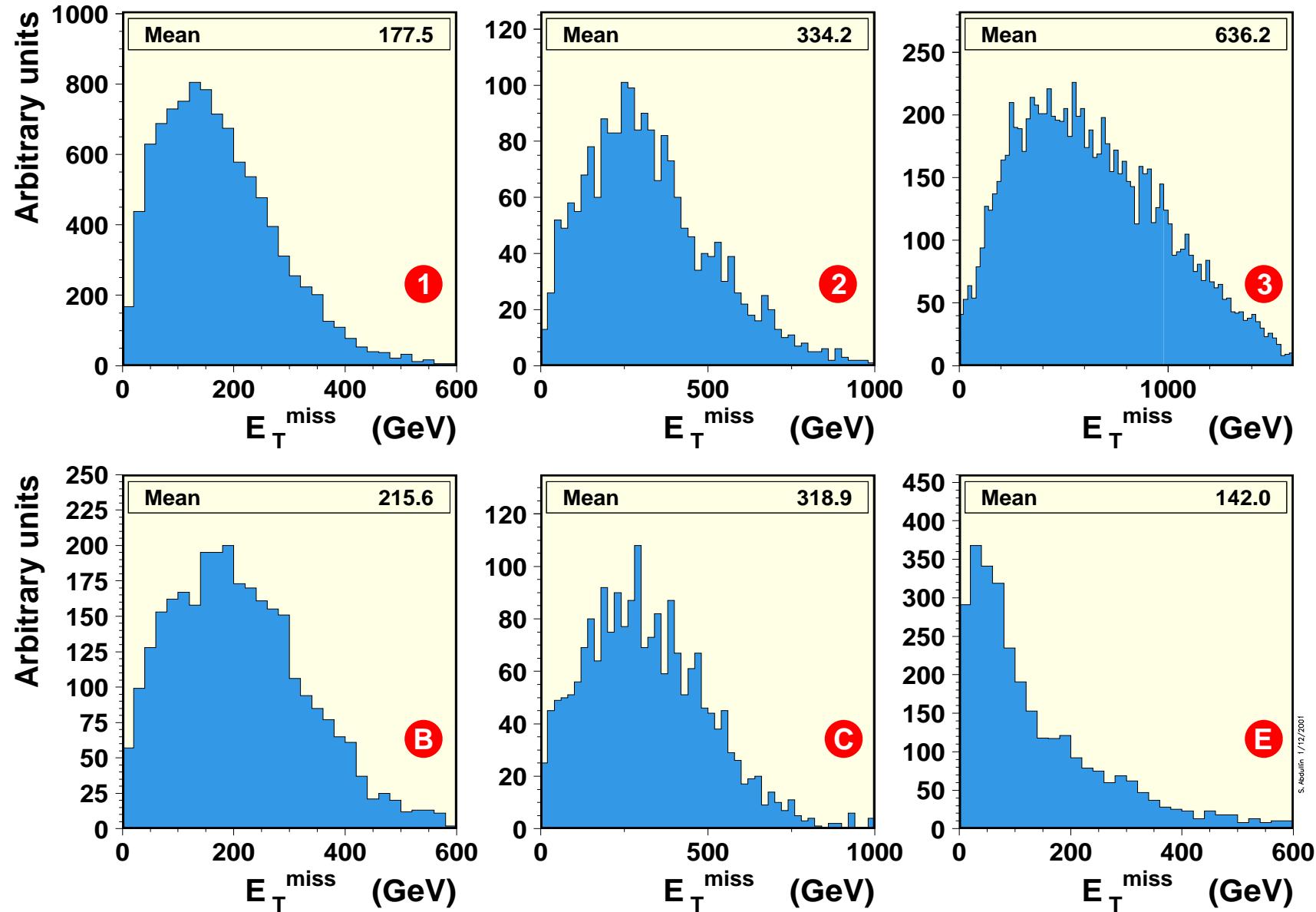
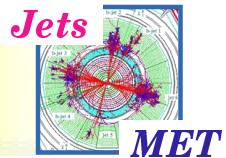


NUMBER OF L2 JETS



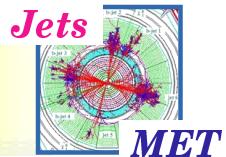


PROBING POINTS DISTRIBUTIONS : L2 MET





L1 SIGNAL SELECTION



■ L1 cuts taken from CMS IN 2001/42 (Wisconsin team)

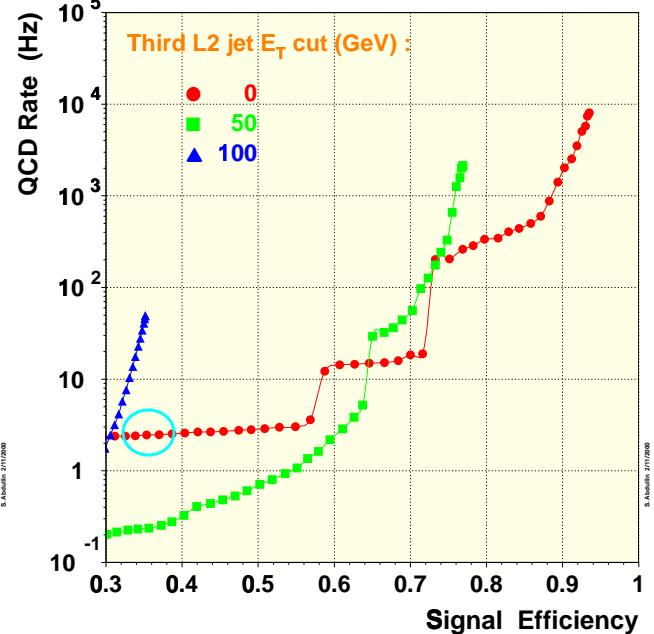
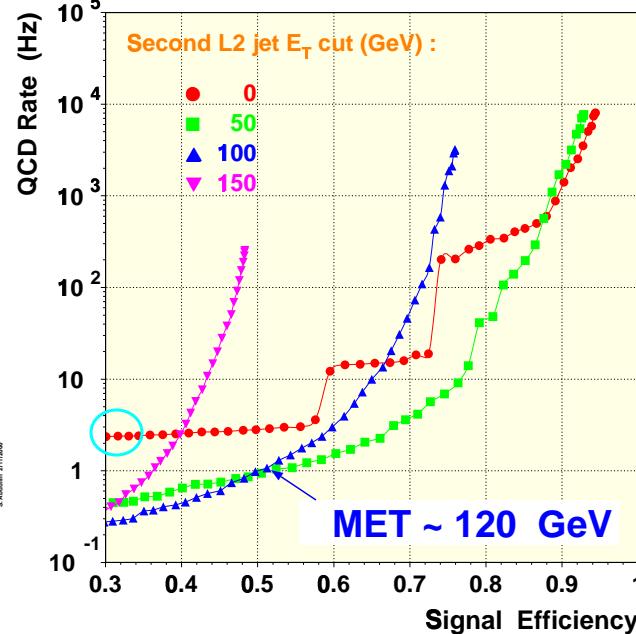
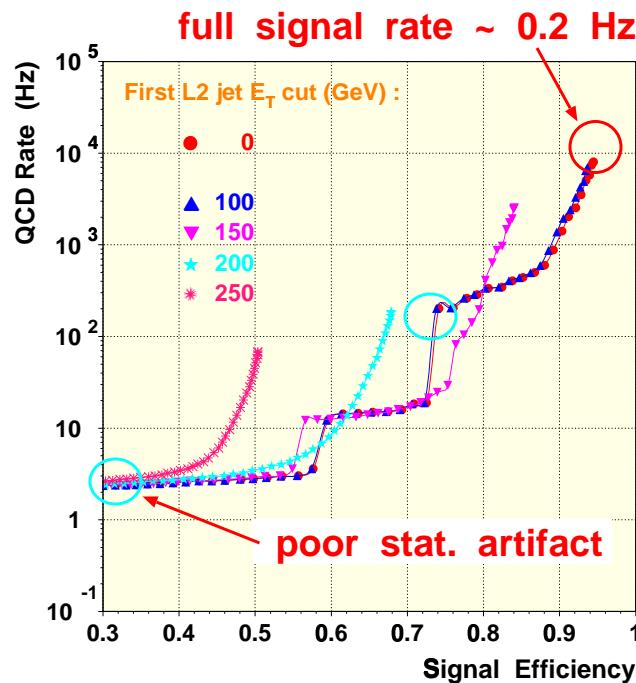
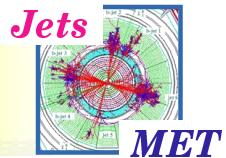
- nominal 12.5 kHz L1 Trigger rate limit is assumed
- L1 jet cuts : 120, 90, 70, 50 GeV for (respectively) 1, 2, 3, 4 jets
L1 MET cut : 100 GeV (95 % at 275 GeV !)

■ Signal cumulative (individual) trigger efficiencies (%)

Point	E_T cut (GeV)				
	j (120)	jj (90)	jjj (70)	jjjj (50)	MET (100)
1	91.5 (91.5)	81.1 (93.3)	58.6 (93.3)	38.2 (94.3)	67.2 (94.5)
2	97.5 (97.5)	93.1 (97.7)	81.6 (98.2)	65.6 (98.2)	88.3 (98.2)
3	98.7 (98.7)	94.8 (98.8)	76.0 (98.8)	53.9 (98.8)	95.8 (98.9)
B	93.2 (93.2)	85.6 (94.4)	66.4 (94.7)	43.7 (97.7)	75.1 (94.9)
C	95.5 (95.5)	89.7 (95.6)	69.6 (95.7)	48.0 (95.8)	86.7 (95.9)
E	59.3 (59.3)	53.5 (60.9)	50.3 (61.1)	46.7 (61.3)	42.5 (61.6)



SIGNAL EFFICIENCY VS QCD RATE AT L2 (I)



Point 1

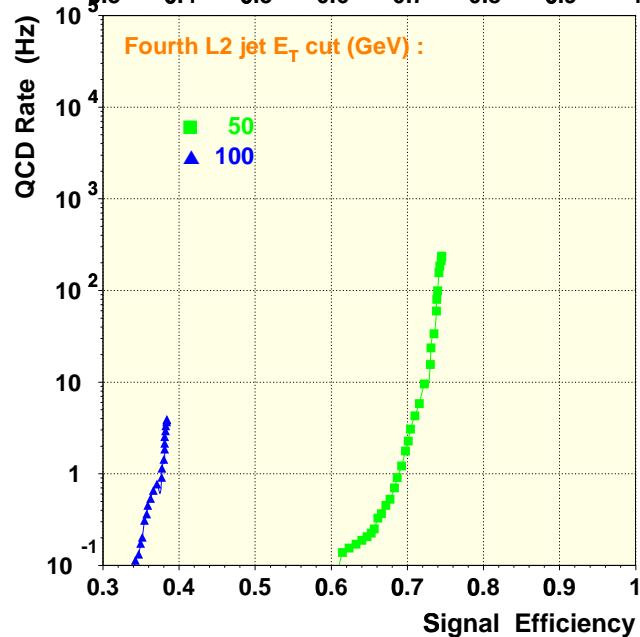
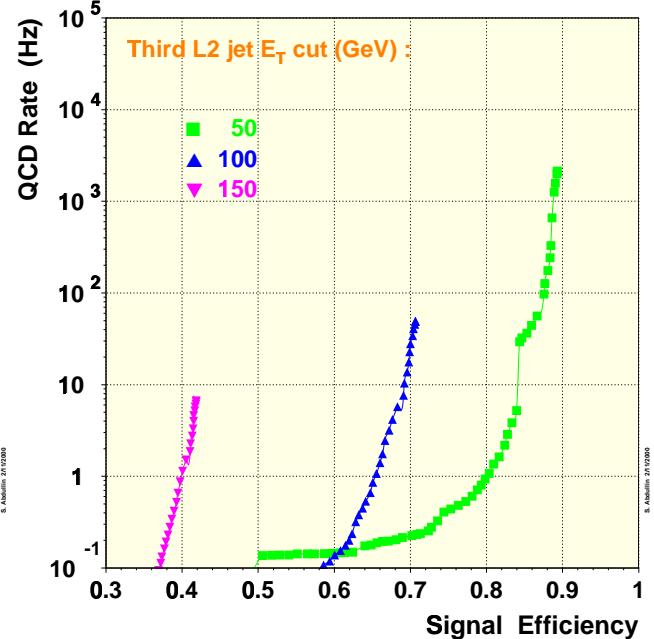
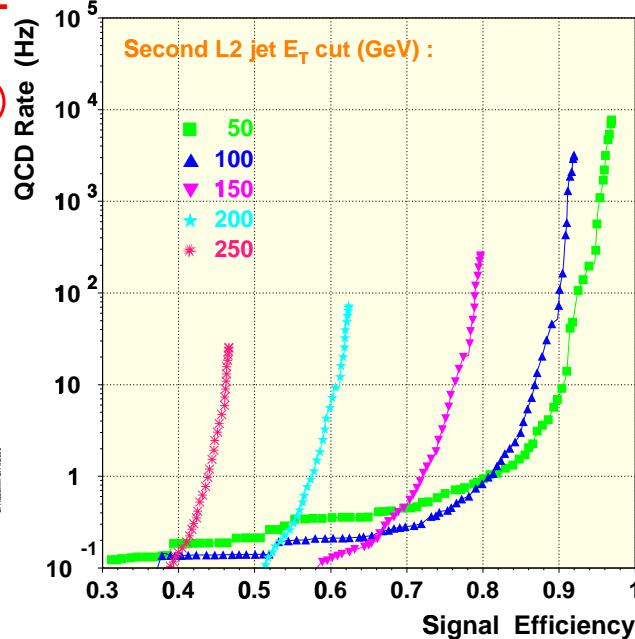
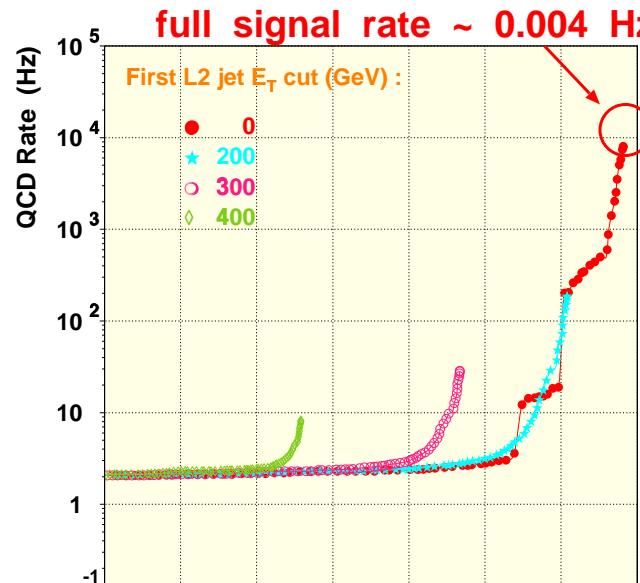
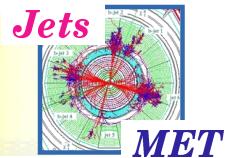
👉 We can preserve ~ 50 % of the signal, while keeping QCD rate at ~1 Hz by one of the next requirements :

- 2 jets with $E_T > 100$ GeV + MET > 120 GeV
- 3 jets with $E_T > 50$ GeV + MET > 110 GeV

👉 MET cut seems to be essential in reducing QCD rate ...



SIGNAL EFFICIENCY VS QCD RATE AT L2 (II)



Point 2



$\sim 80\%$ of the signal at ~ 1 Hz QCD rate

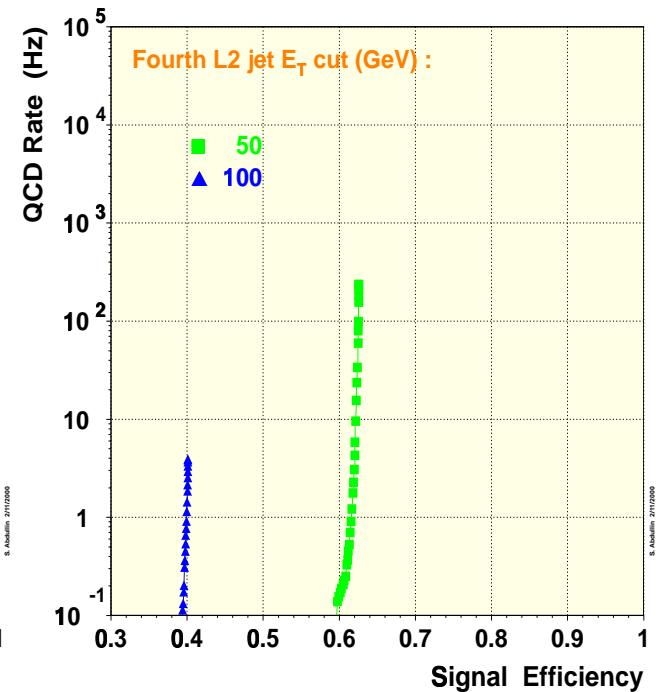
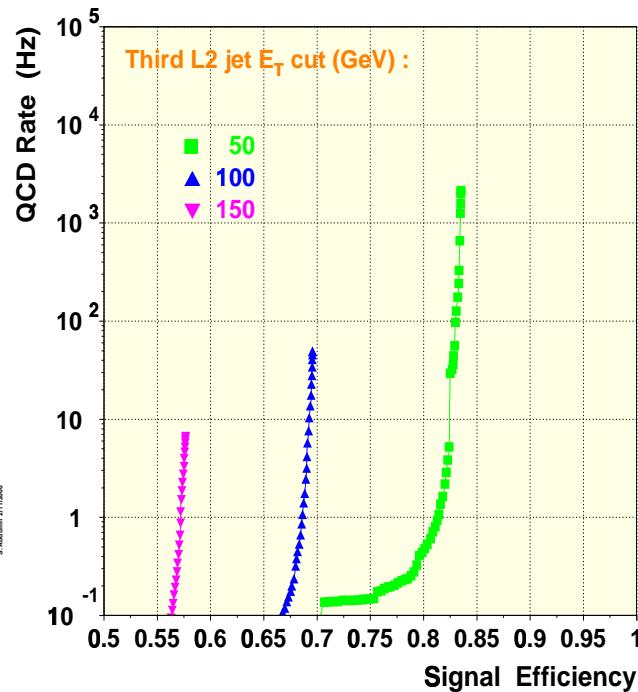
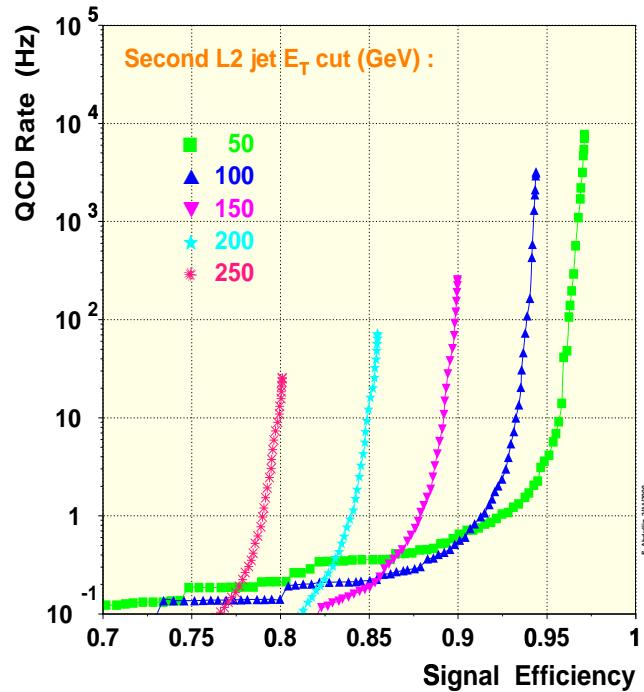
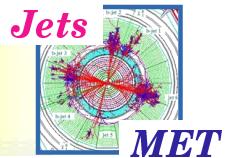
- 2 jets with $E_T > 100$ GeV + MET > 120 GeV
- 2 jets with $E_T > 50$ GeV + MET > 160 GeV
- 3 jets with $E_T > 50$ GeV + MET > 110 GeV



MET cut seems to be essential ...



SIGNAL EFFICIENCY VS QCD RATE AT L2 (III)



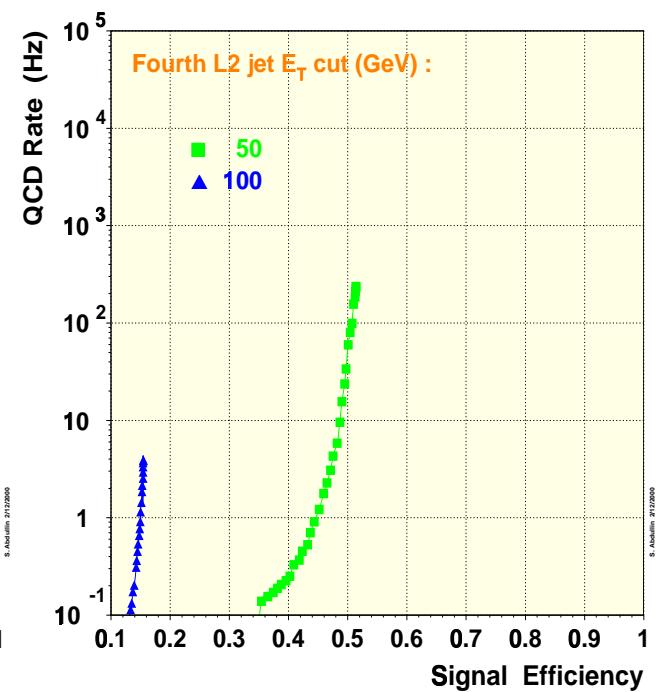
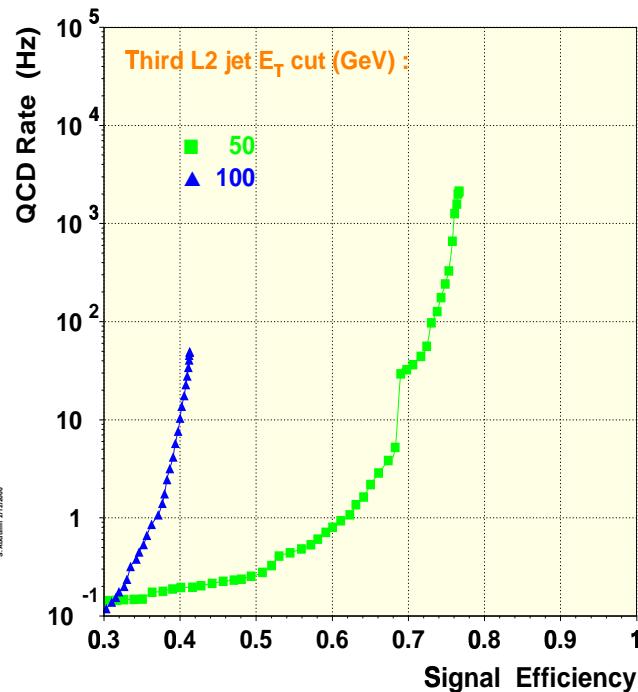
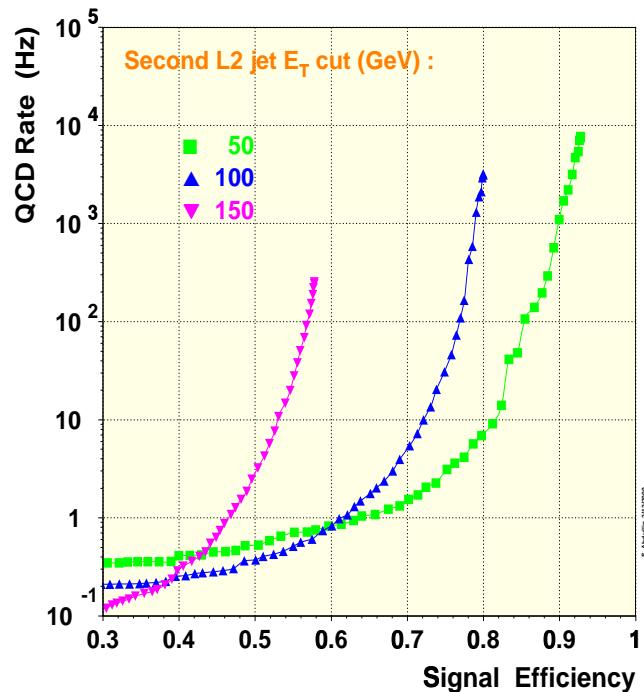
Point 3

👉 92-93 % of the signal at ~ 1 Hz QCD rate with

- 2 jets with $E_T > 50$ GeV + MET > 180 GeV
- 2 jets with $E_T > 100$ GeV + MET > 130 GeV
- 3 jets with $E_T > 50$ GeV + MET > 125 GeV corresponds to ~ 82 % eff.



SIGNAL EFFICIENCY VS QCD RATE AT L2 (IV)



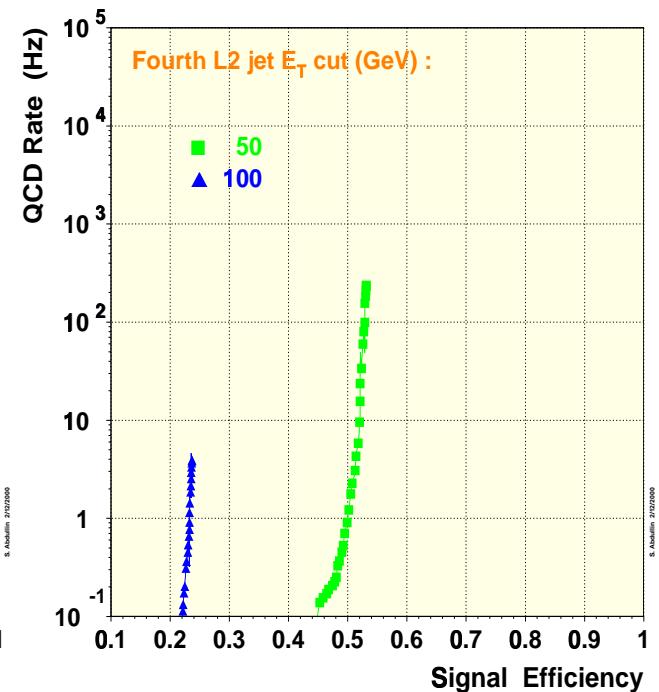
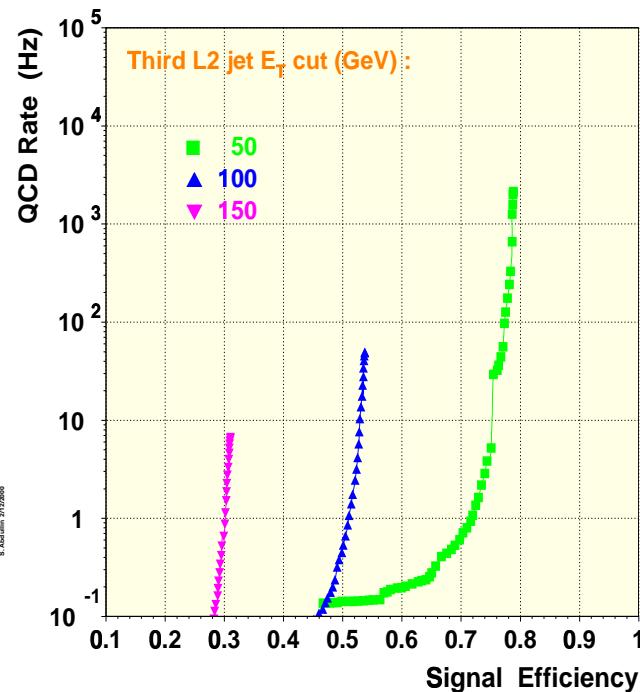
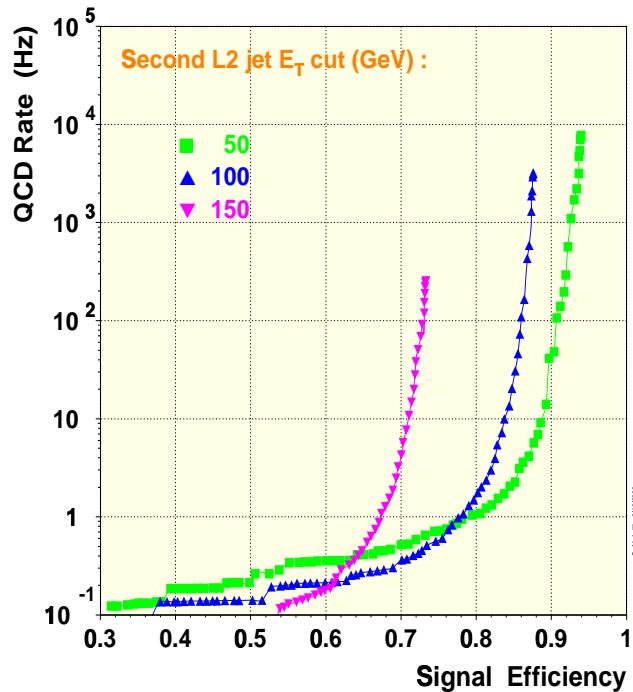
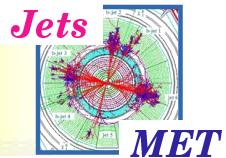
Point B

👉 > 60 % of the signal at ~ 1 Hz QCD rate with

- 2 jets with $E_T > 50$ GeV + MET > 180 GeV
- 2 jets with $E_T > 100$ GeV + MET > 130 GeV
- 3 jets with $E_T > 50$ GeV + MET > 110 GeV



SIGNAL EFFICIENCY VS QCD RATE AT L2 (III)



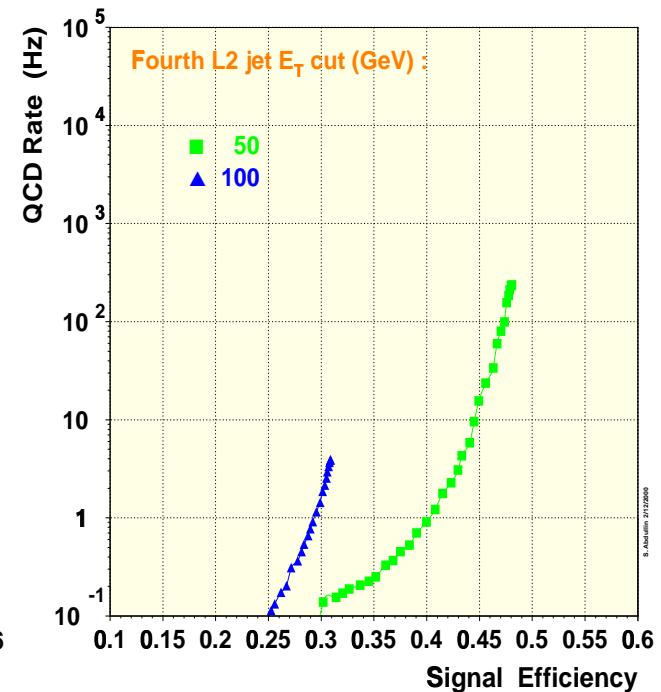
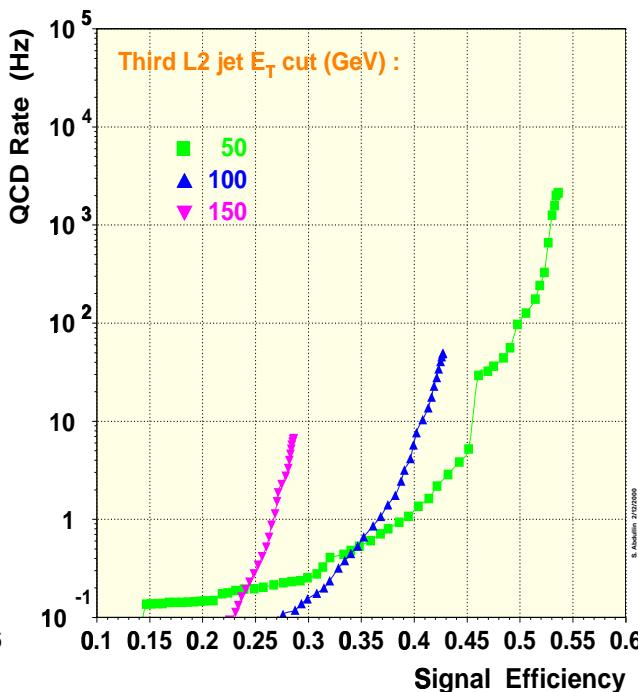
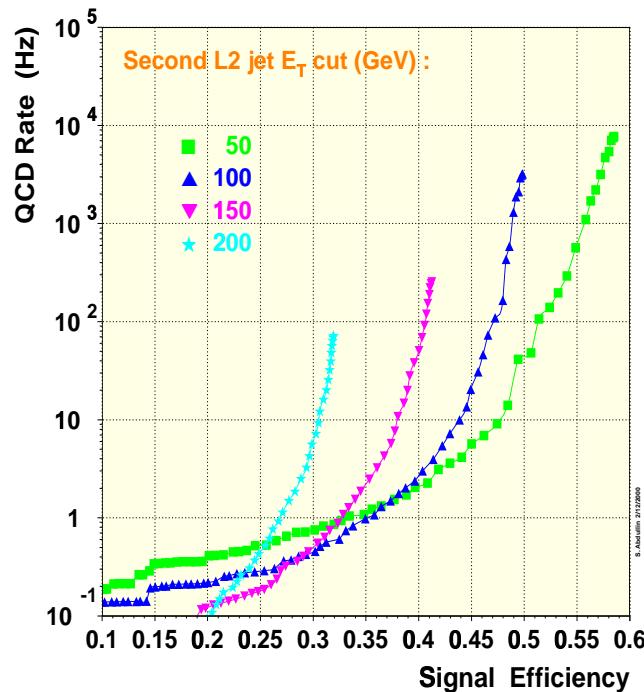
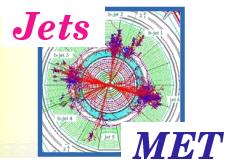
Point C

👉 ~ 80 % of the signal at ~ 1 Hz QCD rate with

- 2 jets with $E_T > 50 \text{ GeV} + \text{MET} > 180 \text{ GeV}$
- 2 jets with $E_T > 100 \text{ GeV} + \text{MET} > 130 \text{ GeV}$
- 3 jets with $E_T > 50 \text{ GeV} + \text{MET} > 120 \text{ GeV}$ gives only ~ 72 % eff.



SIGNAL EFFICIENCY VS QCD RATE AT L2 (III)

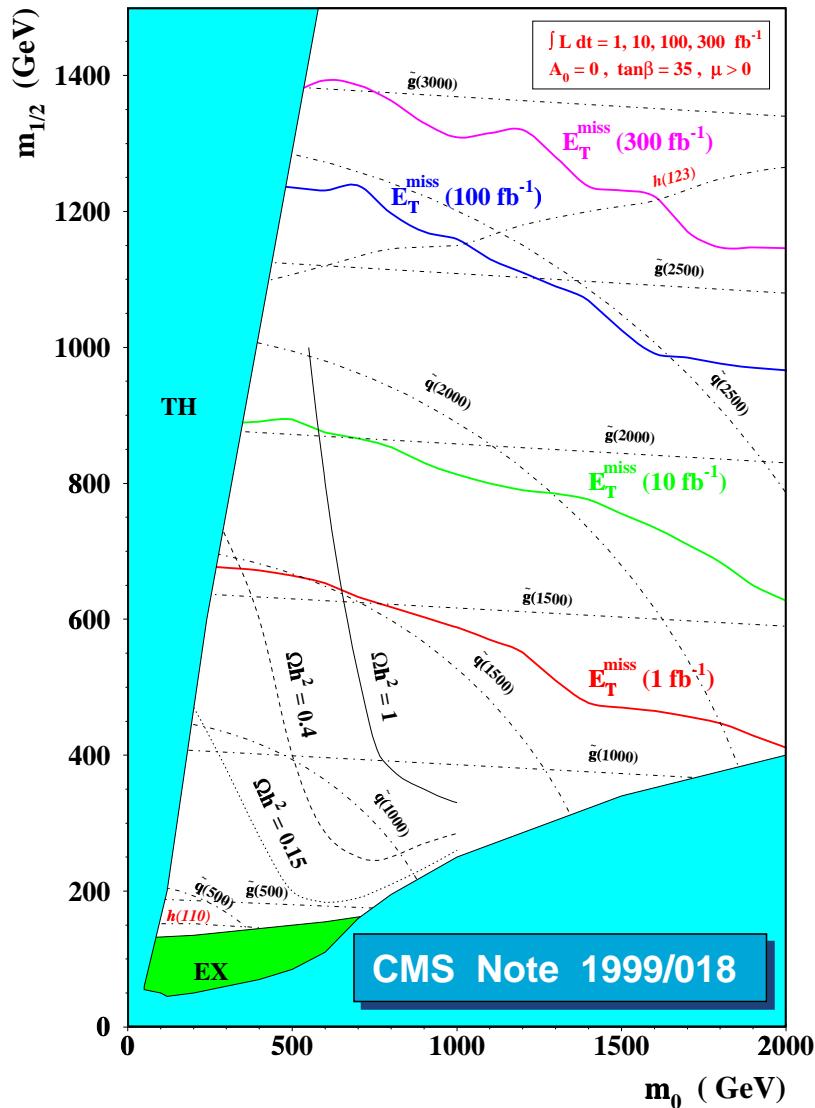
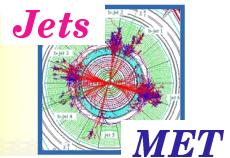


Point E

- 👉 ~ 40 % of the signal at ~ 1 Hz QCD rate with
 - 3 jets with $E_T > 50$ GeV + MET > 110 GeV
 - 4 jets with $E_T > 50$ GeV + MET > 85 GeV
- 👉 5-6 jets requirement is quite typical for such a signal ($m_{\tilde{q}} \gg m_{\tilde{g}}$) in the "off-line" analysis



LAST REMARKS



- ☞ $M_{\text{SUSY}} \sim 2 \text{ TeV}$ is probably reachable already at low lumi ?
According to the LHC plans, 10 fb^{-1} are to be collected in the first 7-months run ...
- ☞ Fortunately, the trigger efficiency increases with the mass scale
- ☞ Some known loss of efficiency occurs if $m(\text{squarks}) \gg m(\text{gluino})$
- ☞ Optimal combination of 1, 2, 3, ... jets + MET triggers to be evaluated soon ...